



RUBIRED and ROYALTY

New
Grape
Varieties
for Color,
Concentrate,
and
Port Wine



H. P. OLMO and A. KOYAMA



Rubired and Royalty are the products of a twenty-year breeding program to develop improved color varieties. In extensive field and wine trials they have shown much promise for

- blending with other grapes to make red wines, especially port;
- making high-quality unblended port wines;
- producing red concentrate.

Advantages:

- Their wines have a stable and attractive dark-red hue.
- When harvested at full maturity, they make high-quality port wines.
- Their vines are vigorous and productive.
- They are quite tolerant to powdery mildew after they reach bearing age and also to red spider and leafhopper.
- Their berries maintain quality over a long harvesting season, do not raisin readily, and process without difficulty.
- Their high acid content, especially in early pickings, is well suited for blends with present port-type varieties, which are too low in acid.

Disadvantages:

- Their high tannin content and bitterness are objectionable in dry table wines, at least if unblended.

This bulletin compares and describes the two varieties and gives suggested cultural methods.

Cuttings of these varieties in limited quantity may be purchased from the Foundation Plant Materials Service of the University of California, Davis.

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RUBIRED and ROYALTY

NEW GRAPE VARIETIES FOR COLOR, CONCENTRATE, AND PORT WINE

HIGH-COLOR GRAPE VARIETIES are used for blending with other grapes in making port, red table, and rosé wines and for producing red concentrate. Color varieties grown in the warmer grape-growing districts of California are also used for making unblended port wine.

In the San Joaquin Valley, where fertile soil and irrigation contribute to maximum yields, and where the bulk of California's standard table wines and practically all the dessert wines are produced, Thompson Seedless is the predominant variety. It remains the favorite for new plantings because it can be used three ways—as a raisin, table, or wine grape. The expanding acreage of this white variety has resulted in a price premium for color varieties.

Red grape concentrate of neutral flavor is widely used as a coloring additive in the food and beverage industries. Its long history as a satisfactory natural product commends its extensive use as a food additive, in preference to newer synthetic materials of doubtful long-term acceptance.

The varieties now available in California for the amelioration of color in wines and for the production of red concentrate are not satisfactory. The color of the Alicante Bouschet, the variety most widely grown for this purpose, sediments out rapidly and oxidizes too readily, and the longevity of the vine is reduced by overcropping and virus dis-

eases. The Salvador, an early Seibel hybrid, is also grown for this purpose; but its color, while intense, is too purplish, and its herbaceous taste lowers the wine quality of the blend.

Furthermore, the high-color varieties, particularly among the *teinturiers* (varieties with color in the flesh as well as the skin of the berry), seldom produce wine of acceptable quality. This is probably because anthocyanin, the red coloring matter in grapes, is synthesized along the same biochemical pathways as tannins and related bitter compounds; hence a high color is apt to be accompanied by high concentrations of objectionable components.

Added winery operations to extract maximum color, either by heating the must or pumping over, are often resorted to; but these operations prevent obtaining the best quality because of excessive oxidation and the extraction of harsh substances. The year-to-year production of blended wines of uniform and reproducible color can best be achieved by having varieties with a high color reserve.

Thus there is need in California for varieties with intense color of attractive hue and good stability. The vines should be vigorous, long-lived, high-yielding, and resistant to or tolerant of the common grape pests. In an attempt to develop one or more such varieties, a breeding program was started in 1938.

The first step was the selection of the parent varieties.

THE PARENTS

Preliminary studies of the color varieties available in our collection singled out the Alicante Ganzin, an early French hybrid, as a producer of abundant color with relatively good stability and a red hue of general appeal, although its wine is of hardly passable quality. The vine cannot be classed as vigorous, but it exhibited high tolerance to both powdery mildew and red spider, two of the most important pests in our vineyards. Alicante Ganzin was crossed with two other color varieties chosen primarily for vigor and the high quality of their wines, but also for other desired characteristics.

The Trousseau (the Bastardo of Portugal) is a variety long known in the San Joaquin Valley for its vigor and productivity of early-ripening fruit that makes excellent dessert wines.

The Tinto Cão, the most ancient variety in the Douro port-wine region of Portugal, makes high-quality wine and adds body and great color stability to the port-wine blend. The vine has high tolerance to powdery mildew and red spider, and its great vigor and minimum care requirements have long been traditional in the Douro, where it is known as "everyman's vine." Its productivity, however, is very low.

CROSSING AND SELECTION

Rubired, seedling H 4-26 and tested under the number S 8, is derived from the cross Alicante Ganzin \times Tinto Cão. Royalty, seedling H 6-28, tested under the number S 26, is from Alicante Ganzin \times Trousseau. The crosses were made in 1938 and the seedlings first fruited in the vineyard in 1942, but evaluation of the seedling vines was delayed during the war, and the first small wine samples were not made until 1947, and then

tests continued for three seasons. In the first cross, 6 out of 137 seedlings were considered promising for further trial, and in the Alicante Ganzin \times Trousseau cross, 18 of 153 were retained for further trial.

The promising selections were established in a trial block at Davis, where eleven vines each were field-budded in August 1950, on rootstocks spaced 6 \times 12 feet. In addition, four standard varieties were included for comparison, Alicante Ganzin, Tinto Cão, Touriga and Trousseau. Both the new selections, of which there were 24, and the four standard varieties were known only by code numbers. Records of individual vine yields, and analyses of musts and wines were continued for five harvest seasons (1952-1956). A preliminary report on the ranking of all selections for a four year period has been given previously.¹ At this time, we need refer only to the two new varieties finally selected and the four standard varieties.

ROOTSTOCKS

Tests have been conducted both at Davis and elsewhere in the state to determine whether the two new varieties are compatible with the most commonly utilized rootstocks. Five to six years' observations indicate that the rootstocks 'Ganzin 1' (Aramon \times *Vitis rupestris*), known as (A \times R #1), *V. rupestris* 'St. George,' and 'Couderc 1613' (*V. solonis* \times Othello) give satisfactory growth and yield. Vineyards have also been established on Thompson Seedless, Grenache, and Mission as rootstocks. In areas of the San Joaquin Valley where own-rooted vines are grown successfully, the Rubired has been somewhat more vigorous than Mission.

It is inadvisable to regraft old vineyard plantings to the new varieties, as experience has shown that virus diseases may be thus transmitted to the new va-

¹ H. P. Olmo. New grapes for color, concentrate, and port. *Wines and Vines*, May 1956, pp. 27-28.

rieties and widely disseminated. If propagating wood is not available in sufficient quantity, it is highly recommended to first plant certified cuttings or rootings of Thompson Seedless or Mission to receive buds of the new varieties. Grenache may also be satisfactory in the better soil types.

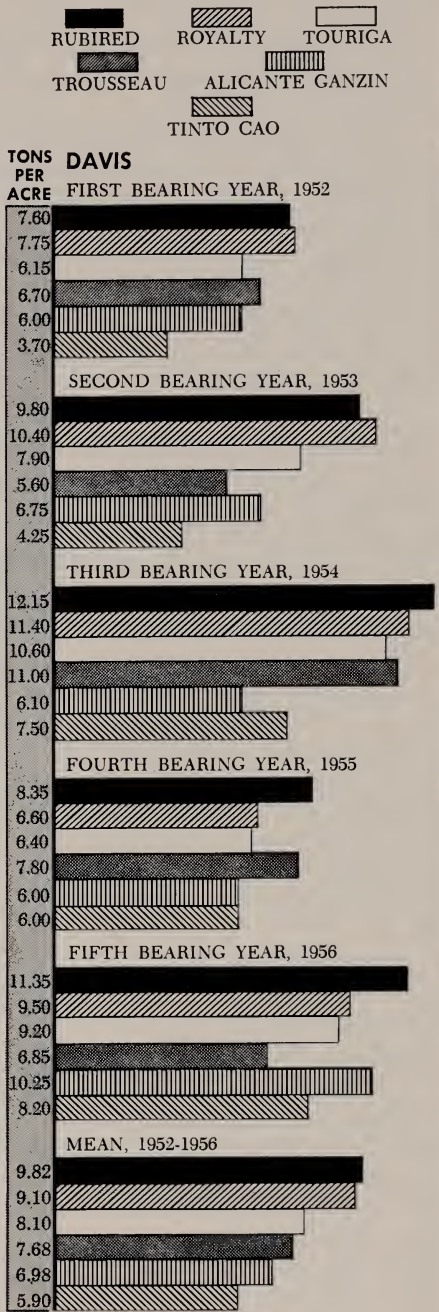
YIELD

The yield records of the Rubired, Royalty, and the four control varieties are charted in Figure 1, for the trial plot located at Davis, for the crop years 1952-1956. The yields for the eleven vine plots were converted to tons per acre on the basis of 600 vines per acre. The two new varieties produced very sizable crops during the first year of bearing, 7.6 tons for Rubired and 7.7 tons for Royalty.

During the next year, in the spring of 1953, a killing frost destroyed all the growth when the shoots were four to six inches in length. Damage was complete and uniform on all varieties in the block. Both Rubired and Royalty were highly fruitful from the new shoots arising from senescent buds in the old wood and the over-all yield was little affected. These two varieties are therefore well adapted to areas subject to occasional spring frost. The Touriga also recovers well and is superior in this respect to the other control varieties. The 1954 season was one of heavy crop, Rubired producing 12.1 tons and Royalty 11.3 tons per acre. The depressing effect of this heavy crop on the yields the following year is evident. The mean yields for the first five crop years place the Rubired and Royalty as the highest yielding, the Tinto Cão the lowest.

Attention must be directed to the condition of the fruit at harvest time. It is actually the yield of sound fruit that is important. The only varieties of the group showing any fruit spoilage in the field were the Trousseau and to a lesser extent the Touriga. The condition of the

FIG. 1.
COMPARATIVE YIELDS OF
RUBIRED AND ROYALTY AND
FOUR PORT-WINE VARIETIES.



Actual yield data have been converted in this table to tons per acre. These figures are subject to about 10% error.

fruit on arrival at the winery was rated each year from fair to very good, indicating absence of spoilage. There were no significant differences between the varieties, and all processed without difficulty. All the varieties had good foliage cover and sunburning of the fruit was not a problem.

Both Royalty and Rubired ripen in midseason, some 3 weeks later than the Trousseau at Davis. In the Fresno district the harvest will be in early to mid-September. An excellent feature of the fruit is that it can be left on the vine for a considerable time with little deterioration in quality. Damage from unseasonable rains is negligible.

We have observed that the berries shell off readily at picking time if the fruit is allowed to get overripe. This tendency is more pronounced in the Royalty than in the Rubired, but the losses reported are negligible. The best yield and retention of the red color is obtained before the fruit reaches 24° Balling.

WINE TRIALS

Each year for seven seasons, wine samples were made under a code number, also used in the vineyard planting, so that all tastings were blind and the samples were never identified as to variety or parentage until the conclusion of the trials.

Since 1952, 5-gallon samples of port-type wine have been made each season, held for one year in small oak cooperage, then bottled.

The methods of must and wine analysis are those generally used in this laboratory.² Soluble solids and extract were determined with Balling hydrometer, total acid (as tartaric) by direct titration to a phenolphthalein endpoint, pH by glass electrode meter, alcohol by hydrometer after distillation, tannin by the Neubauer-Loewenthal method, and

color by Dubosc color comparator with a standard dye mixture.

These wines have been tested at intervals of about every 6 months since they were prepared, and the results are given in Table 1. The quality ratings are composites of several hundred individual tasting scores. The method of scoring is that used previously in rating new varieties: a scale of 0 to 10 has been very satisfactory. Here 0 represents a wine that cannot be judged, because of spoilage or accidents that occurred as the result of faulty preparation or handling. The score of 5 is used as a comparative point, chosen to represent an average commercial wine of standard quality available at the time. All wines were judged as a port-type class. Thus the low scores of Trousseau, for example, were attributable to the very pale and poor color, rather than to any deficiency in flavor or all-round quality.

The tasting results are summarized for each wine. In column *a* are the averages of two industry groups in the Fresno area, in which mostly wine technologists of the district participated. In column *b* are the averages of the Davis group of tasters. More value was attached to high color in the Fresno tastings, whereas the Davis panel did not put emphasis on this characteristic and were more discriminating. A disturbing feature is the extremely wide variability between the wine samples of the same variety, even though the wine-making techniques are presumed to be standardized.

The total acidity of the musts of Rubired and Royalty is considerably higher than that of the varieties now recommended for port-wine production. At 23° to 24° Balling, Tinta Madeira ranges from 0.50 to 0.60 in total acid, as compared to the 0.70 to 0.80 of the Rubired and Royalty. If the latter are not permitted to ripen to 22° Balling or more, the wine has sometimes been penalized

² M. A. Amerine. Laboratory procedures for enologists. 124 pp. University of California, Davis, September, 1960. (Mimeo.)

TABLE. 1. ANALYSES OF MUSTS AND WINES

VARIETY	Date of harvest	MUST				WINE							Quality score†	
		Balling degree	Acid, g/100 ml	pH	Balling degree	Acid, g/100 ml	pH	Volatile acid	Alcohol, per cent	Extract, g/100 ml	Tannin, g/100 ml	Color*		
													a	b
<i>Alicante Ganxin</i>	Oct. 14, 1952	24.0	1.03	3.37	5.2	0.63	4.25	0.03	23.0	12.1	0.31	1429	1	1
	Nov. 2, 1953	20.5	1.17	3.32	0.79	3.88	0.02	19.5	12.5	0.26	833	6	4
	Oct. 5, 1954	21.3	0.98	3.34	4.8	0.75	3.75	0.02	20.4	10.9	0.33	715	2	1
	Oct. 18, 1955	22.0	1.01	3.46	6.4	0.72	3.87	0.02	18.8	12.1	0.28	3334	8	5
<i>Royalty</i>	Oct. 15, 1952	24.6	0.77	3.52	6.6	0.68	4.20	0.04	19.2	12.6	0.32	1429	4	4
	Oct. 20, 1953	21.5	0.90	3.42	5.9	0.61	3.85	0.04	20.2	12.1	0.21	823	8	7
	Oct. 5, 1954	21.8	0.72	3.30	4.5	0.57	3.62	0.02	19.8	12.1	0.21	475	3	4
	Sept. 18, 1955	21.1	0.68	3.39	7.4	0.51	3.79	0.01	18.8	12.2	0.20	1000	8	7
	Sept. 29, 1958	19.1	0.61	3.49	3.5	0.41	3.82	0.03	19.8	9.5	0.08	143	7	7
	Oct. 26, 1958	27.4	0.52	3.48	8.4	0.47	4.01	0.02	18.9	13.9	0.21	625	8	7
<i>Rubired</i>	Oct. 2, 1952	22.1	1.05	3.35	6.1	1.01	3.90	0.09	17.4	11.2	0.30	3333	2	2
	Oct. 20, 1953	22.3	1.03	3.41	8.6	0.74	3.90	0.02	18.4	14.1	0.27	1667	6	6
	Oct. 5, 1954	21.7	0.85	3.30	5.5	0.63	3.72	0.02	19.7	11.5	0.24	555	1	1
	Oct. 18, 1955	22.7	0.71	3.52	8.1	0.59	3.88	0.03	19.4	13.2	0.06	1666	7	5
	Sept. 29, 1958	22.5	0.78	3.45	6.8	0.60	3.85	0.02	19.4	12.5	0.16	334	8	7
	Oct. 20, 1958	26.2	0.60	3.42	8.2	0.54	3.99	0.02	19.5	14.0	0.24	625	8	7
<i>Tinto Cão</i>	Oct. 2, 1952	22.2	0.80	3.37	5.9	0.48	3.63	0.03	20.8	11.6	0.09	24	2	2
	Oct. 19, 1953	23.5	0.73	3.72	8.8	0.65	4.27	0.05	18.2	14.4	0.08	189	8	7
	Oct. 5, 1954	22.0	0.66	3.60	5.7	0.45	4.20	0.03	20.0	12.0	0.08	415	6	4
	Oct. 4, 1955	22.2	0.65	3.61	7.4	0.51	4.12	0.03	19.3	12.5	0.02	116	3	2
<i>Touriga</i>	Oct. 14, 1952	23.5	0.68	3.55	3.9	0.50	4.32	0.05	20.1	10.2	0.07	222	3	2
	Nov. 2, 1953	22.8	0.81	3.49	0.54	4.18	0.03	19.1	14.1	0.07	128	6	5
	Oct. 5, 1954	20.6	0.83	3.50	7.1	0.47	4.20	0.01	19.9	11.1	0.24	270	6	5
	Oct. 18, 1955	21.9	0.70	3.69	7.6	0.41	4.23	0.02	19.1	12.9	0.11	204	4	5
<i>Trousseau</i>	Sept. 23, 1952	24.9	0.59	3.88	6.0	0.32	4.52	0.03	20.7	12.3	0.03	18	3	2
	Oct. 19, 1953	24.7	0.61	3.97	8.5	0.46	4.26	0.03	18.9	14.2	0.03	10	4	4
	Oct. 5, 1954	24.0	0.68	3.64	6.5	0.49	3.70	0.05	19.6	12.9	C.01	7	4	5
	Sept. 18, 1955	20.7	0.56	3.70	7.4	0.40	3.71	0.02	19.1	12.5	0.02	9	4	5

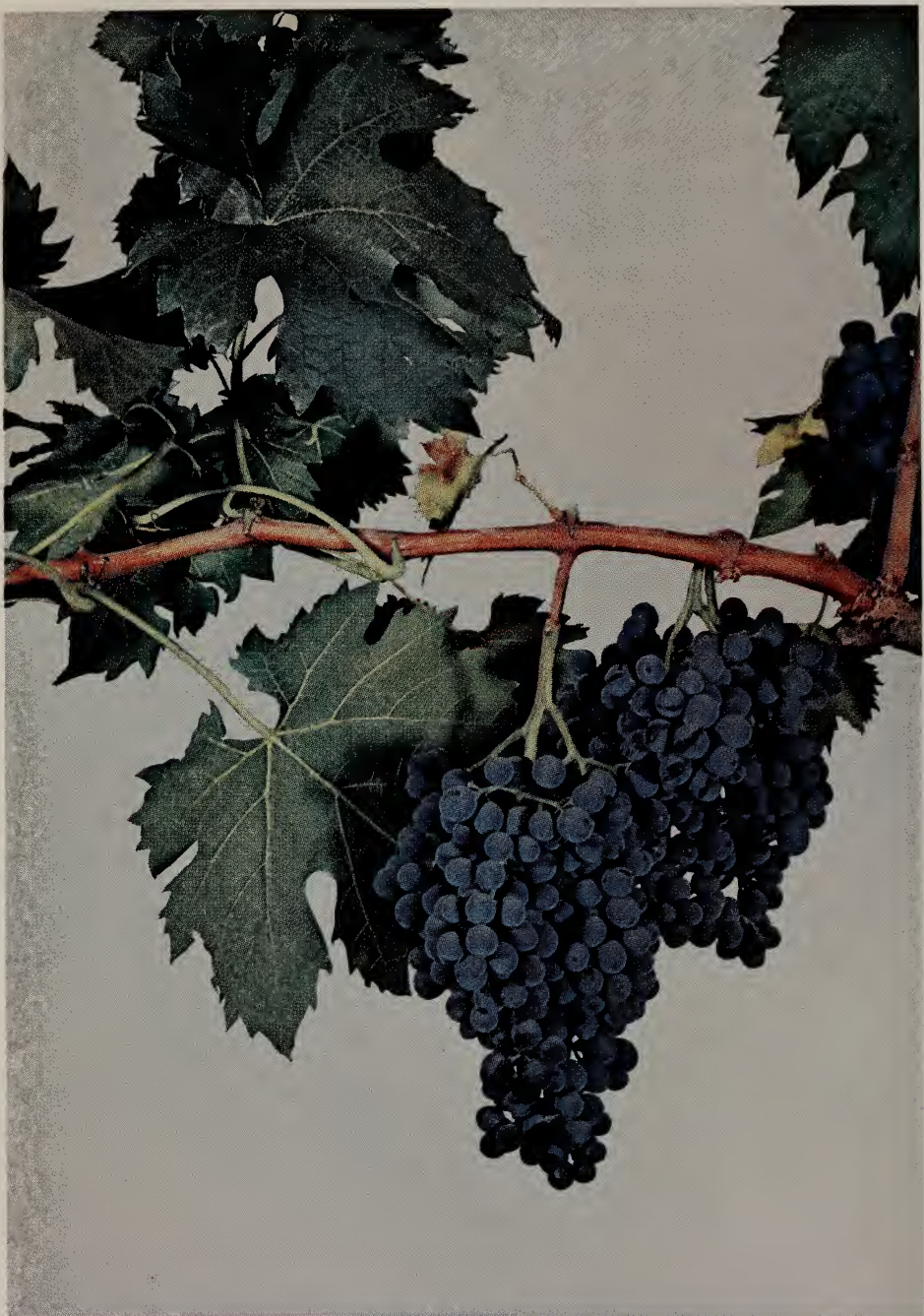
* By Dubose color comparator with a standard dye mixture.

† Column *a* is a summary of the scores of two industry groups at Fresno, column *b* of Davis tasters.



Rubired has rounded leaves and maroon-red shoot tips; its cluster stems are often purplish. Grapes are shown one-third actual size.





Royalty has deeply lobed leaves, green shoot tips, and slightly pointed berries. Both Royalty and Rubired have colored juice and are excellent midseason color varieties for blending with white varieties in making port wine.

by judges because of tartness and lack of mellowness. On the other hand, these varieties harvested at high acid content are admirably suited for blending, as all port-type varieties now entering our wineries are too low in acid. The extra acidity is a useful protective factor in maintaining the quality of grapes that are allowed to accumulate high sugar content. It will be noted in Table 1 that musts of even 26° or 27° Balling produce wines that have scored very high for both Rubired and Royalty. The quality of the grapes for port-type wine is thus maintained over a long harvesting season, and the higher sugar content guarantees more profitable conversion by the winery. The fruit does not raisin readily, a process that downgrades many varieties because of the "overripe" taste of the wine. The optimum maturity depends on the season and the use to which the crop is put. This should be determined by local experience.

The color values of the wines are very high, in most seasons equivalent to the Alicante Ganzin, and more than double the Alicante Bouschet when cropping levels are held about equal. The dark red color is easily extracted and does not have the purplish hue of the Salvador. The color is well retained in processing of concentrate, and wine aged up to eight years has good color content for port-type wines.

Past experience has indicated the desirability of large-scale vineyard and winery tests before a new wine variety is finally released. Both Royalty and Rubired have been tested in ½-acre plots and large wine lots made under commercial conditions. Three years of testing at one large winery have yielded completely satisfactory results, with no difficulties encountered in harvesting, processing, fermentation, or aging.

Both varieties are also excellent base varieties for the production of concentrate.

Dry table wines have also been made,

but the scores have been below average. The high tannin is then objectionable, although blending may correct this fault.

CULTURAL METHODS

Rubired and Royalty are heavy-producing varieties. Hence pruning should at first be sufficiently short as to control overbearing in the young vineyard. One or two bud spurs are satisfactory. The Royalty reached heavy production even in the first few years, so that the crop should be kept in bounds until the vines have a chance to develop their full framework. Crop reduction in the Royalty might be necessary in the first two or three years of bearing, and this is most readily done by removing excess shoots in the head of the trunk in April, as all of these are fruitful. This will also aid in forming a better head and result in less labor at pruning season in culling out excess canes.

Head-pruned vines can produce maximum crops. The use of cane pruning for Royalty is not recommended because overbearing in certain seasons can result and severely weaken the vine. If bilateral cordons are used, thinning out of shoots or blossom clusters must be carefully done in years of heavy crop. This can be most readily accomplished by rubbing off excess shoots when the most advanced growth is 8 to 10 inches long.

Even after eight to ten years, the Royalty vine remains only of medium size, so that very wide planting distances would probably not give maximum yield. In the better vineyard soils, a spacing of not more than 81 square feet to the vine appears satisfactory. In trellised vineyards, this would be a 6 × 12 or 7 × 12 spacing. The Rubired, however, ultimately develops a large framework, and the wider distances are recommended, or approximately 100 to 120 square feet per vine, in trellised vineyards 9 × 12 or 10 × 12.

Rubired and Royalty have been grown

in experimental plots at Davis without sulfuring for powdery-mildew control for five years. Neither the crop nor growth of vine was adversely affected. The Rubired is very tolerant and no damaging attacks of mildew have occurred. Royalty, in the seasons very favorable for mildew development, will show late spotted growth of the fungus on the canes and cluster stems, but it has not been heavy enough on older vines to cause any commercial damage. Growth

and yields of untreated vines have paralleled those of the dusted vineyard area. Both varieties can be considered to be commercially tolerant to powdery mildew in the sandier soils of the San Joaquin Valley, but young vines with excessive growth should receive one or two applications of sulfur dust.

Both varieties are much less attacked by red spider and leafhopper than are standard varieties now grown. The Rubired is more resistant than Royalty.

DESCRIPTION OF ROYALTY

Vine. Of medium size and vigor, bushy, compact, very leafy, shoots from senescent buds always highly fruitful, recovery from spring frost excellent. Fairly tolerant to powdery mildew, and better than average tolerance to red spider and grape leafhopper. Leaf fall late.

Shoot tips. Light green, only slightly arched, unexpanded leaves light yellow-green with light covering of white woolly hair, only faintly bronzed, expanding rapidly to form a very leafy shoot, leaves losing pubescence when about 2 inches broad, becoming glabrous and shiny above and below, finally dark green above.

Leaves. Dark green, medium green underneath, deeply lobed, central lobe square in outline, superior sinuses very deep, open, wide, closed by the overlapping lobes; inferior sinuses deep, open, wide, U-shaped; petiolar sinus medium wide, U-shaped, fully open. Petiole very short, two thirds or less of midrib, thin, wiry, with faint wash of purplish pigment. Teeth large, in two series, apical teeth of all lobes large and acute, teeth unsymmetrical with one side rounded and mucron tip often hooked. Autumnal coloration a light reddish-orange, late in appearance.

Canes. Short, with offset internodes, giving zig-zag appearance, surface uniformly ribbed, circular in outline, pith cylinder small, dormant buds very small, narrow, flattened along one axis, with conical, but markedly loose scales, light chocolate, soon becoming strongly procumbent and at maturity drooping, with prolific growth of short, sterile secondary lateral shoots, producing abundant leaf surface and covering the fruit from view. Fruit clusters at least two and often three on vigorous canes, borne on second and third node and even up to the sixth node. Secondary and tertiary clusters are large in size and compare favorably with the primary. Second-crop clusters from lateral shoots rarely formed.

Primary clusters. Symmetrical, long conical, 10 inches \times 5.5 inches, loose to well-filled, weigh about $\frac{1}{2}$ pound each and have a mean of 230 berries. A

winged tendril is fruit bearing, averaging 53 berries. The cluster stems are slender, woody only at the base, free hanging, about 2 inches in length, easily cut at harvest.

Berry. Ellipsoidal, bluish-black, heavy bloom, with pointed tip, size³ 9 grams (Carignane 22), with prominent corky lenticels, skin thick, tough, resistant to cracking, flesh firm, juicy, very deep red in color, easily detaches or shells from capstem, pedicel medium, rigid, tapered, torus small. Seeds small, two to four, occasionally five per berry.

DESCRIPTION OF RUBIRED

Vine. Large, vigorous, semi-upright, open growth habit, senescent buds in old wood fruitful, easily trained and pruned, very tolerant to powdery mildew, and more than usually tolerant to red spider and leafhopper. Leaves retained on the vine very late in the autumn. Shoot unusual in that the growing tip is not arched, but erect, reaching full development with 26 to 35 nodes; when exposed to the sun, deep maroon in color, especially the tendrils, and only faintly striated.

Shoot tips. Young leaves lightly woolly, maroon, light yellow-green above and below, on expanding, soon becoming shiny and completely glabrous, surface concave.

Leaves. Mature leaf very dark green above, strongly contrasted with light green below, surface strongly and widely undulated, with slightly reflexed borders, in this resembling the Alicante Bouschet; upper side of primary nerves at petiole suffused maroon, glabrous, shiny. Teeth very broad, sharp, apex obtuse, few in number, in only two series. Superior sinuses usually lacking on one side or reduced to a narrow, deep inlet with parallel sides, inferior sinuses reduced to a notch or absent. Petiolar sinus medium wide, deep, V-shaped. Petiole the same length as leaf midrib, base only slightly bulged at point of attachment to shoot, medium thick, very flexible and strong.

Canes. Of medium vigor, very straight, semi-erect, round in cross-section, dark brown with nodes shaded much darker, the darker color extending to few wide, striated bands, very smooth surface; secondary shoots few but vigorous, seldom bearing fruit. Buds of dormant canes medium, heavily and tightly scaled, long conical and sharply tapered, flattened laterally. Tendrils bifid, rigidly horizontal, unusually slender and very weakly coiling, soon becoming inactive and dying back. Clusters usually three per cane; on third, fourth and sixth nodes.

Primary clusters. Short conical, averaging 2 inches shorter than Royalty, loose to very loose, weighing slightly less than Royalty, and with a mean of 158 berries; stem when exposed washed with purple pigment. A very long, loose wing bears a small side bunch with an average of 39 berries.

Berry. Ellipsoidal to slightly obovoid, apex rounded, lenticels prominent, skin thick, good adherence to pedicel, flesh firm, juicy, with deep red color, size 12 grams (Carignane 22), usually three seeds per berry; pedicel rigid, very thin toward base, longer than Royalty.

³ Mean weight of the ten largest berries per cluster.

DISTINGUISHING CHARACTERISTICS OF THE TWO NEW VARIETIES

Both varieties are *teinturiers*, producing colored juice when the berries are crushed.

Royalty is a medium-sized and very bushy vine of drooping habit, with

deeply lobed leaves, and *green shoots*, with slightly *pointed berries*.

Rubired is a large, erect, open-growing vine, with *rounded leaves*, resembling Alicante Bouschet; deeply colored *maroon-red shoots*; shorter clusters; and berries that are rounded at the bottoms; cluster stems often purplish.

ACKNOWLEDGMENTS

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HOW THE UNIVERSITY OF CALIFORNIA WORKS WITH AGRICULTURE

As one of the nation's Land-Grant institutions, the University of California plays a multiple role in service to agriculture. This involves teaching, research, and conveying the facts developed by research to those who may put them to good use in the best interest of all the people.

These activities are combined in the University's *Division of Agricultural Sciences*. This statewide framework includes:

The *College of Agriculture* providing instruction in agriculture and related sciences on campuses at Berkeley, Davis, Los Angeles, and Riverside. The *Schools of Forestry* and *Veterinary Medicine* function as separate professional schools within the Division but are closely related to the College of Agriculture.

The *Agricultural Experiment Station* conducting research on the four campuses mentioned above as well as on numerous field stations, experimental areas, and farms throughout the state. Closely allied with the Experiment Station are the *Giannini Foundation of Agricultural Economics* and the *Kearny Foundation of Soil Science*.

The *Agricultural Extension Service* with 53 offices serving 56 counties carrying out the responsibility of "extending" research results to the people. The service cooperates with the Experiment Station in local research on thousands of farms. It also conducts youth educational activities through the 4-H Club program.